

PEI XXX: MEASUREMENT TECHNIQUES

L	T	P	Cr
3	1	0	3.5

Introduction: Definition, Application and types of measurements.

Error Analysis: Types of errors, Methods of error analysis, Uncertainty analysis, Statistical analysis, Gaussian error distribution, Chi-Square test, Correlation coefficient, Students t-test, Method of least squares, Curve fitting, Graphical analysis, rejection of data.

Static and Dynamic characteristics: Dynamic analysis of instrumentation system, relative merits of analytical and experimental modelling of dynamic behaviour, Response of zero, first and 2nd order system to step, Pulse, Harmonic and random test signals, Frequency spectra, Auto correlation spectral density, Loading effects under static and dynamic conditions, Simulation of dynamic response.

Generalized measurement system: Different functional elements (Sensors, Signal condition (Regeneration, Conversion, and Shaping) signal manipulation, Data transmission, Data presentation, Inverse transducers). Review of conventional devices, technologies and introduction to recent ones.

Measurement of electrical and electronic quantities: charge, current, voltage, power, power factor, energy, reactive power, megger, low resistance measurement, high resistance measurement, non contact type current measurement, magnetic flux, electric field, electrical phase noise, electrical amplitude noise, electrical spectral density, transconductance, electrical power gain, voltage gain, current gain, frequency gain.

Applications: conventional and recent measurement techniques for measurements of Temperature, Pressure, Flow, Level, Shaft power Torque, speed, vibration, Viscosity, pH, Humidity.

Course learning outcome (CLO): After the completion of the course the students will be able to:

1. Apply different techniques for the analysis of errors
2. Analyse the response of systems for various test signals
3. Explain different sensors and signal conditioning circuits.
4. Elucidate techniques for the measurement of the Shaft Power Torque, speed, vibration, Viscosity, pH, and Humidity
5. Examine various techniques for the measurement of Temperature, Pressure, and Flow.

Recommended Books:

1. *Measurement system, Application & Design, E.O. Debelin, McGraw Hill*
2. *Handbook of Transducers. H.N. Norton, Prentice Hall*
3. *Electronics Instrumentation and instrumentation technology, M.M.S Anand, Prentice Hall*

4. *Experimental methods for engineers, J.P Homan, Tata McGraw Hill*
5. *Course in Mechanical Measurements and Instrumentation and Control, A.K. Sawhney, P. Sawhney, Dhanpat Rai & Company, 2001*

Evaluation Scheme:

Evaluation Elements	Weightage (%)
MST	30
EST	45
Sessionals (May include Assignments/ Projects/ Tutorials/ Quizes/ Lab Evaluations)	25